THE NATIONAL COMMISSION ON MATHEMATICS AND SCIENCE TEACHING FOR THE 21ST CENTURY

MINUTES OF THE MEETING OF MAY 8-9, 2000

Commission Members Present:

Sen. John Glenn, Chair
Deborah Loewenberg Ball
Craig R. Barrett
Diane J. Briars
Sandra Feldman
Gov. James E. Geringer
Javier Gonzalez
Jerilyn Grignon
Jeffrey Himmelstein
Rep. Rush Holt
Anne Jolly
Paul L. Kimmelman
William E. Kirwan
Maria Alicia Lopez-Freeman
Walter E. Massey
Iris T. Metts
Rep. Connie Morella
Edward B. Rust, Jr.
Dennis Van Roekel
Bruce Alberts (ex officio)
Jerome F. Smith, Jr. (ex officio)
Linda P. Rosen, Designated Federal Official

Other Attendees:
V.J. Agarwal (for Neal F. Lane, ex officio)
Kelley Coyner (for Sec. Rodney F. Slater, ex officio)
Peter Faletra (for Sec. Bill Richardson, ex officio)
Karen Garr (for Gov. James B. Hunt, Jr.)
Alice Gill (with Sandra Feldman)
Kathy Havens (with Edward B. Rust, Jr.)
Jay Labov (with Bruce Alberts, ex officio)
Joan Rothenberg (with Rep. Rush Holt)
Judy Sunley (with Rita R. Colwell, ex officio)

MAY 8th

Opening Remarks

The National Commission on Mathematics and Science Teaching for the 21st Century met on May 8, 2000, at the Washington Plaza Hotel in Washington, D.C. In accordance with the provisions of Public Law 92-463, the meeting was open to the public. Rosen, Executive Director and Designated Federal Official, called the meeting to order at 3:30PM, and noted that the meeting was being taped. She turned the meeting over to Senator Glenn, Chair of the Commission.

Senator Glenn asked for approval of the minutes of the March 6-7, 2000, meeting. The Commission so moved and the minutes were approved without objection. A signed copy of the minutes will be posted on the Commission's web site.

Senator Glenn welcomed new member Metts, Superintendent of Prince George's County (MD) Public Schools. Senator Glenn reported that a tentative date for the release of the Commission's report has been set for October 2nd or 3rd. He reviewed current thinking about the Commission's products. The centerpiece of the Commission's release would be a 10-12 page document targeted to a broad public audience. The Department of Education would be responsible for its wide dissemination. Accompanying the centerpiece would be "Calls to Action" or checklists targeted to various math and science education stakeholders; a 5-6 minute video highlighting the Commission's recommendations for distribution to school board members and possibly other stakeholders; and a more substantive, web-based document providing additional explanation of and justification for the Commission's recommendations.

Goals for the Meeting

Senator Glenn said that the goals for the meeting are to give clear guidance to the staff on the draft report, to agree on a set of recommendations, and devise a process to create the "Calls to Action." He recognized the following Commission members for their work with staff in preparation for the meeting: Ball, Barrett, Kirwan, Massey, as well as Labov on behalf of Alberts, and Sunley on behalf of Colwell. Senator Glenn also expressed his appreciation to the staff.

Overview of Draft Recommendations

At Senator Glenn's request, Rosen summarized data points and Commission members' sentiments from previous meetings. There are 1.5 million elementary school generalists and 300,000 middle and high school math and science teachers, of whom 28 percent of math teachers and 18 percent of science teachers are teaching out-of-field. Each year approximately 24,000 new middle and high school math and science teachers are needed, of which about 16,000 are new to the field. Elementary, middle, and high school math and science teachers have different sets of needs. Only half of the college students who intend to go into teaching actually do so. Student achievement gains in math and science are disappointing. To address these challenges, the Federal government, states, business community, and K-16 educational community must work together on short- and long-term strategies that are aligned with state and local standards. Three key issues have emerged: the shortage of qualified math and science teachers, the lack of content- and pedagogical content-rich math and science preservice

and inservice for teachers, the need to empower teachers as professionals and make a teaching career more attractive.

Rosen reviewed three overriding recommendations and strategies to address each that have emerged from the Commission's work to date:

- To significantly increase the supply of knowledgeable math and science teachers, two ideas have been proposed: (a) A Fellowship Program to attract and prepare recent college and post-baccalaureate math and science majors and mid-career adults; and (b) service scholarships for undergraduates.

- To significantly increase teachers' knowledge of effective teaching methods and content in math and science at all grade levels, two ideas have been proposed: (a) a program focused on developing teacher leaders or coaches; and (b) providing all elementary school teachers with a high-quality curriculum-based professional development experience.

- To create a career ladder with appropriate financial incentives and an intellectual environment that attracts and keeps high quality math and science teachers in the profession, a partnership between states and the business community would be established. Partnership program ideas include: state matching funds for capacity-building among the math/science teaching force, business funds to reward high performing schools, and financial support for National Board certification with bonuses for completion.

Another idea from previous meetings is to recommend that all states implement new forms of teacher compensation in support of higher quality teaching. Rosen noted that several models for teaching compensation based on performance, knowledge, and skill will be discussed at this meeting. Three other ideas have not yet been melded into concrete recommendations: (1) how to provide regular time for teachers' self-reflection; (2) how to give teachers access to and knowledge of the tools they need to increase their professionalism, e.g. technology; (3) whether to create an entity that would oversee and track the nation's success in implementing the Commission's recommendations.

Rosen echoed Senator Glenn's request for feedback on the proposed ideas and suggested that they consider whether these are the "right" recommendations, what ideas might be missing, the scalability of the recommendations, and the likelihood of raising the necessary funds to support them.

In response to Albert's concern that the timing of the Commission's recommendations might appear to support the ideas of one Presidential candidate over the other, Senator Glenn responded that the Commission has representation from both political parties and its goal is to recommend the best for education and U.S. students. Massey suggested mentioning the role of parents and other support groups if it could be done without diluting the Commission's focus on teachers. Metts suggested creating benchmarks for the current state of math and science teaching and progress needed. Kirwan questioned the scale of the Fellows program and suggested that additional academies might be necessary. He also recommended having a single set of academies to provide both the training for new teachers and the inservice training. Himmelstein suggested that a role for elementary school principals be incorporated. Ball said that a clearer connection needed to be made between the problems and the recommendations, that

the recommendations should address instruction and instructional quality, and should more directly impact on student learning. Governor Geringer commented that there is a shortage of skilled workers in most professions and that technology was the way to try to leverage more capability. He suggested a greater emphasis on the shortage of skilled teachers; emphasizing the importance of teacher preparation institutions and giving incentives to colleges of education faculty; focusing on role of principals to leverage good teachers and teaching; tying the teaching experience directly to business; and utilizing technology more effectively.

Gonzalez commented that it is difficult for individual teachers to make change. The whole school should be involved in changing instruction and the buy-in of administrators and school board is critical. He suggested that a mandate or money with strings attached may be required. Briars recommended that the long-term recommendations needed greater emphasis. She noted that changing the system overall will require a huge outlay of funds, something on the order of magnitude of Title I, and that the scale of the recommendations may need to be bigger. She wondered how to give the coordinating entity the necessary clout for an ongoing, sustained effort. Briars also mentioned that in discussing professional development, it is important to convey the notion of building a professional knowledge base and having teachers be an integral part of building that base.

Presentations: Pay for Performance and Knowledge and Skills-Based Pay Plans

Senator Glenn introduced the speakers: Carolyn Kelley, Associate Professor of Educational Administration at the University of Wisconsin-Madison who has conducted research on the motivational effects of compensation on teachers, and Thomas Gillett, 1st Vice-President and Chief Negotiator of the Rochester Teachers Association and a National Board Certified Teacher.

Carolyn Kelley: Research on Teachers Compensation Systems

Kelley shared ideas for strategic use of teacher compensation to better support the educational goals of schools. She said that incentives are embedded in any compensation system and incentives can be used to promote desired outcomes. She described group-based performance, including school-based performance pay, and contrasted it to merit pay. School-based pay uses compensation strategically to support long-term improvement in organizational capacity to perform at a high level. Kelley suggested that school-based performance pay provides incentives for collaboration among teachers, whereas individual merit pay provides more incentives for competition among teachers.

Kelley said that knowledge and skill-based pay provide pay increases for demonstrated improvements in knowledge, skills, and expertise needed to improve student achievement. In contrast to career ladders, Kelley said that knowledge and skills-based pay target the skills a teacher can use in the classroom. She presented examples of districts that have or are developing models and indicated that the two performance pay approaches can help define and raise performance expectations and standards of professional practice. Commission members posed a number of questions concerning salary comparisons with other professions, the assessments used to determine performance, the effect of these systems for high-risk populations, and how the success

of these systems compare with simply providing teachers with appropriate materials and support. Senator Glenn called for a short break.

Thomas Gillett: The Teacher Union Reform Network (TURN)

Gillett described the Teacher Union Reform Network (TURN), which was created to promote change among teacher unions and to facilitate reforms in education resulting in better learning and student achievement. Gillett said that because 90 percent of the nation's teachers are members of either the American Federation of Teachers or the National Education Association, partnering with unions is vital to implementing meaningful and sustained change.

Gillett described the group incentive plan used in Rochester, N.Y. and suggested such plans could be adjusted to focus on math and science teaching and learning. He recommended that the Commission listen to students, particularly about math and science teaching techniques and strategies. He suggested that teachers in unions are key to developing new models to improve student achievement, and whether through collective bargaining or some other collaboration, they must be full partners in the process.

Plenary Discussion: Financial Incentives for Math and Science Teachers

In response to Kimmelman's question about the impact of individual teachers versus a group or a department, Gillett said that excellent individual teachers are needed to engage other members of the faculty in professional development, to reflect on what is best practice, and to identify ways to encourage the extension of good practices. He noted that teachers still don't have salaries that are competitive with other professions, that in other professions additional learning, interaction with colleagues, and reflective practice are expected and occur routinely, and that if we want to change how students learn, these practices need to occur in schools.

Rust commented that focusing on improved academic achievement by students should drive the Commission's thinking. Governor Geringer asked about models for merit or enhanced pay that look at achievement across time rather than across a school year or single test; Gillett noted that student mobility makes it difficult to collect such data. Sunley, on behalf of Colwell, pointed out that recommendations that deal with incentives and salary are difficult to tailor specifically to math and science. Briars responded that districts will undertake those tailored activities, such as math and science, for which they have funding, but if what is carried out is effective and desirable, there will be pressure from within the system to extend those efforts to other content areas through other sources of funds. Gill, on behalf of Feldman, said she had not heard convincing data that performance pay resulted in better student achievement, or that it would address some of the problems, such as lack of teacher content knowledge or how students learn math and science. She suggested that the Commission will need to carefully frame its recommendations broadly enough to allow for State and local flexibility in implementation but not so broadly that they are interpreted in a way that would have no effect. In response to Massey's question about other indicators that show a strong correlation to student performance, Gillett said that studies suggest that the critical variable to ensure higher achievement is the quality of the teacher, and the second variable is job-embedded professional development.

The meeting adjourned for dinner at 6:33PM.

MAY 9th

Overview for the Day

Senator Glenn called the meeting to order at 8:40AM. He reiterated the meeting's goals and remarked that there is not one clear leverage point to help improve the preparation of math and science teachers. The Commission's challenge is to help move more programs to high quality and to offer ideas that are big and bold.

Kirwan mentioned an article in *The Washington Post* about Montgomery County (MD) students' 60 percent failure rate on the algebra exam. The article cited a school with better results, and quoted math teachers as crediting hard work–noting that teachers meet before and after school to tutor students–provide two periods of algebra a day for struggling students, and make calls to the parents of students who miss class. Senator Glenn asked that copies of the article be distributed to Commission members.

Senator Glenn introduced the speakers: Gail Shroyer is Associate Professor of Education and Coordinator of Professional Development Schools at Kansas State University; and Susan Sclafani, Chief of Staff for Educational Services in the Houston Independent School District.

Gail Shroyer: Teacher Preparation and Professional Development

Shroyer suggested that contrary to popular belief, teaching is the most complex and challenging profession. She said that a national consensus on what teachers should know and be able to do is needed, one that is based on performance-based standards and should be used to accredit all schools of education and credential all teachers. Good math and science teachers need a deep understanding of essential concepts and processes of science and math, pedagogical content knowledge, and reflective and analytical practice within the context of the school day. To achieve these goals, Shroyer suggested several critical requirements: collaboration and support; a series of developmentally appropriate yet rigorous courses and field experiences; and modeling, in content methods courses and field experiences, a wide variety of effective teaching and assessment strategies. Shroyer recommended the need to promote a professional vision of teaching and of teachers as reflective decision-makers. She said that expectations must be raised for teachers, and that undergraduate teacher preparation be linked with professional development to provide a continuum between these two experiences. The entire K-16 system needs to be viewed as a continuum and there should be a link between student performance, teacher performance, and accreditation for colleges. She also suggested reexamining the roles and responsibilities for all educators including faculty from the colleges of arts and sciences.

Susan Sclafani: Alternative Routes into Teaching

Sclafani gave an overview of the Houston student population and teacher shortages in Texas. Houston's 13-year old alternative certification program has focused on recruiting in shortage areas, including math and science. Sclafani identified the program's critical success factors: a thorough selection process based on transcript analysis and

background reference checks; university-based high quality course work closely coordinated with the alternative program; summer preparation seminars and classes involving observation of teaching practice and debriefing; practice teaching, and weekly opportunities to discuss issues and challenges and reflect on their experiences. Intern support in the classroom is critical, particularly for those from other fields; therefore, the program provides a mentor teacher, observation and feedback from school principals, and an alternative certification program specialist who visits the classrooms regularly and observes and conducts model lessons. Opportunities for growth are also critical and include release time from the classroom to observe in other classrooms; assistance for the state certification exams; and encouragement to participate in other professional development opportunities. Sclafani said the interns include individuals right out of college, some changing fields in mid-career, and some who have retired from other fields. She reported that their five-year retention rate for the alternative certification program is 60 percent compared to 50 percent for regularly certified teachers. She said that they believe the way to keep high-performing people is to offer higher salaries and hope to convince the state to move away from a salary schedule that links the length of time in teaching to salary levels.

Commission members asked a number of questions concerning similarities between schools of education and other professional schools, measures of success such as student achievement and retention rates, the science background needed for quality prospective teachers, the ethnic mix of the interns recruited for the Houston Program, and whether the learnings from Houston's alternative program were transferable to traditional programs.

Governor Geringer commented on the similarities in what works in the programs described by the presenters and noted that a key difference is that Houston's program responds to an urgent need to bring people into the profession on an accelerated schedule. Shroyer said that the essential components to a successful program are one-on-one support for teachers once they are in the classroom and a partnership of the colleges of arts and sciences, colleges of education, and school districts.

Alberts suggested that education schools and teacher preparation programs might benefit from competition and recommended making prototypes of good teacher preparation courses over the web.

Ball suggested that the key to the success of both programs is a curriculum focused on the essential practices that people have to learn. She said it might be useful to look at how other professions prepare their practitioners to be effective. She advised focusing on how to shift the preparation of teachers and the improvement of teaching toward practice. She proposed recommending a series of summer school programs during which both teachers and students would have the opportunity to increase their mathematics and science learning and that these practices be put on the web for others to study.

Jolly suggested members consider recommending a National Science and Math Education Security Act which would use some portion of the projected Federal surplus to guarantee an equitable opportunity for every student to receive a quality education in math, science and technology.

Senator Glenn called for a break after which members would proceed to their breakout groups. The meeting would reconvene at 1:30PM after a working lunch. Senator Glenn introduced the provocateurs who would join the breakout groups: Richard Elmore, professor of education at Harvard, Donald Langenberg, Chancellor of the University of Maryland, and Barbara Cervone, National Coordinator of the Annenberg Challenge and Associate Director of the Annenberg Institute. Members proceeded to their break-out sessions at 10:30AM.

Plenary Discussion: Small Group Reports

Rosen called the meeting to order at 1:40PM. Reporting for his group, Governor Geringer said that the urgency is economic security for society and business. A declining capability in math, science, and technology in the workforce would have a detrimental effect overall. A quality skilled workforce is needed, requiring competent quality teachers and learners. Governor Geringer summarized the group's recommendations: to significantly increase the supply of knowledgeable math and science teachers; to increase math and science learning; to increase teachers' knowledge of effective teaching methods and content; to connect with and build on relevant existing efforts nationwide; to recognize and reward both students and teachers; and to demonstrate to business the need to invest in education and to provide summer partnerships for teachers to work in businesses.

Reporting for the second group, Gonzalez suggested the following problem statement: Our American youth are performing poorly in math and science based on TIMSS and NAEP. The problem is not just a teacher shortage; the main focus must be on the quality of instruction. A quality focus might mean extensive initial inservice training with professional development throughout the year, and integrating technology to enhance teacher development and student learning. Currently, curricula in mathematics and science are scattered and shallow. The group's recommendations include: deepening the existing curriculum for teacher preparation; providing teachers with the right materials; and encouraging business to invest in education through teacher internships and consulting opportunities. Possible funding sources would include business and Title I monies for professional development.

Reporting for the third group, Ball said that the Commission's recommendations should ensure that every student is taught mathematics and science by a highly qualified K-12 teacher and that all students master the scientific and mathematical knowledge needed for success in the 21st century. The goal is to build a system of continuous improvement by improving the way mathematics and science is taught with a focus on teaching and learning. Features of a system of continuous improvement would include: a focus on students learning mathematics and science, a focus on practices that lead to students' learning, and a focus on teachers' learning that support practices that develop student learning. Recommendations include: summer mathematics and science academies, providing teachers with research and development environments for the improvement of their practice, creating a database of effective practices, and systematic professional development.

Provocateurs: Reflections on Emerging Recommendations

Elmore opened his remarks with some observations about the educational system that would have to implement the Commission's recommendations. He suggested that the

design of the current educational system is fundamentally flawed, with a shallow and highly fragmented curriculum for students, a standards movement that often reinforces shallow learning, and teachers who have not received the kind of treatment in the work place or opportunities to master the skills and knowledge they require. He continued that the culture of teaching unfortunately equates autonomy with professionalism, lacks a common code of practice, and does not subject a teacher's practice to empirical validation. The infrastructure also is weak in its support and development of curriculum and teaching skills. He concluded that the quality of teaching in the classroom won't be improved by putting highly qualified people into the existing culture. Elmore proposed the creation of an alternative culture with improvement, not maintenance of the status quo, as its purpose. He suggested content-based teaching study groups that would develop lesson models based on the process of learning about teaching and learning and that used the school district as the unit of improvement. This more professional and fluid infrastructure would cut across jurisdictional boundaries and would utilize professional associations and networks to disseminate video examples of effective teaching.

Cervone recommended that the commission have a very clear and compelling statement about what it's trying to do and to create an audience for its work; focus on a limited number of things it can do well and not promise more than it can deliver; focus on those people needed to implement the recommendations; have a clear sense of the barriers and a strategy for addressing them; and find the opportunities for leverage and know what to build on and how to integrate.

Langenberg noted that the scale of the problem the Commission is addressing is vast. He said that the greatest service the Commission could perform is to design a system that will accomplish all the goals it has laid out. He recommended developing a business plan that lays out the costs, resources, and time projections. He suggested that much more reliable and scientific information about what works in the teaching and learning of math and science is needed. Langenberg said that motivating the audience for the report will be critical and suggested that fear may be a good motivator.

Additional comments were made by Commission members and provocateurs about time constraints on teaching and how to find more time for teachers, how the Commission's focus fits into the overall education reform and improvement agenda, and the need for studying the impact of technology and how it can be most effective in improving education.

Senator Glenn called for a break at 3:15PM.

Plenary Discussion & Next Steps

At Senator Glenn's request, Rosen facilitated the remaining discussion. Rust suggested the need for a clear statement of the problem. Himmelstein said that compelling arguments were critical and reiterated that fear is a great motivator. Senator Glenn responded that the public should fear for their children, their future jobs, their standard of living, and U.S. leadership. Kirwan suggested that while there is agreement on the symptoms, perhaps no one group can define what may require a 10-15 year solution and that the Commission's task may be to define the first steps. Senator Glenn asked if a ten-year plan was needed.

Barrett suggested that one approach would be to use standardized testing to quantify the problem, thereby putting pressure on local school boards and principals and the local populace. He recommended a program build around three precepts: to upgrade the current base of teachers, to get more people interested in teaching, and to provide rewards and recognition for students and teachers. He indicated that business money will provide support only for reward and recognition for results. He suggested building on proven programs rather than inventing new ones.

Members discussed incentives, standardized testing, benchmarking, internet technology, academic performance indicators, accountability, resources, and science curriculum. Sunley, on behalf of Colwell, said that the report must convince the public, the school systems, and the states that the quality of the product coming out of the schools really matters.

Senator Glenn noted the final meeting is scheduled for July 13-14 and the report release will be on either October 2 or 3. The meeting was adjourned at 4:35PM.

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This is to certify that the minutes of the May 8-9, 2000 meeting of the National Commission on Mathematics and Science Teaching for the 21st Century are true and accurate to the best of my knowledge.

(Signed by John Glenn)	July 13, 2000
John Glenn, Chairman	Date